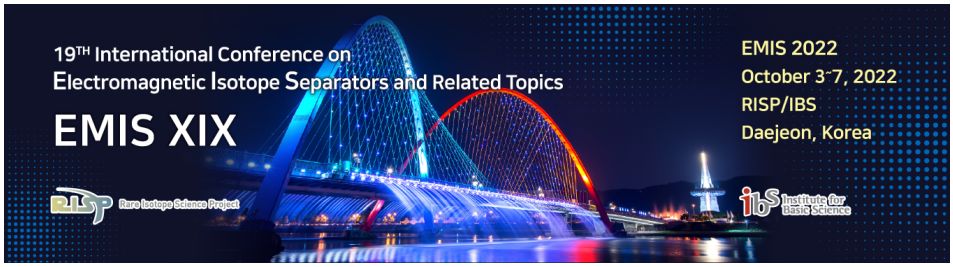

Contribution ID: **49** Type: **Poster Session**

Optimized production and extraction of medical grade Ac-225

Monday, 3 October 2022 17:50 (8 minutes)

^{225}Ac radiopharmaceuticals are being developed for the treatment of certain distributed cancers using targeted alpha therapy. However, supply shortages of ^{225}Ac itself strongly constrain the progress of such research [1]. As a consequence, a number of accelerator-based production routes are being pursued at different facilities worldwide. Alongside the ^{226}Ra(p,2n)^{225}Ac and ^{226}Ra(γ, nβ) ^{225}Ac reactions, the high-energy (>70 MeV) proton spallation of natural Thorium or Uranium targets can produce high in-target yields of ^{225}Ac [2,3]. Once ^{225}Ac has been produced in an irradiated target, it must then be extracted, limiting how much can be recovered. Presently this is performed by radio-chemical separation of the target or by mass separation of a radioactive ion beam.

According to the target material and the primary beam energy, different quantities of ^{225}Ac, its β-decay parent ^{225}Ra ($t_{1/2}$ = 14.9d), and the long-lived contaminant ^{227}Ac ($t_{1/2}$ = 21.8y) are produced. As a consequence, the subsequent separation technique must be adapted to the irradiation conditions to maximize extraction efficiency, in addition to satisfying facility constraints, isotopic purity requirements for drug manufacture and hospital waste handling [4].

In this work the simulated in-target yields of ^{225}Ac, ^{225}Ra and ^{227}Ac for irradiations at different proton-spallation-capable facilities are presented. The optimum techniques for subsequent ^{225}Ac separation, with consideration to efficiency and isotopic selectivity, are then discussed. Emphasis is put on the method of resonant laser ionization and mass separation, for which an upper efficiency bound and isotopic selectivity have recently been experimentally determined for separations performed at the CERN MEDICIS facility [5]. The results are interpreted in the context of the global effort to scale up ^{225}Ac production to meet the increasing demand for this isotope.

References:
[1] Bruchertseifer, F., et al. A. Targeted alpha therapy with Bismuth-213 and Actinium-225: Meeting future demand. J. Label. Compd. Radiopharm. 62, 794–802 (2019).
[2] Robertson, A. K., et al. Development of ^{225}Ac radiopharmaceuticals: TRIUMF perspectives and experiences. Curr. radiopharmaceuticals 11, 156–172 (2018).
[3] Griswold, J. R., t al. Large scale accelerator production of ^{225}Ac: effective cross sections for 78–192 MeV protons incident on 232Th targets. Appl. Radiat. Isot. 118, 366–374 (2016).
[4] Eychenne, Romain, et al. “Overview of the most promising radionuclides for targeted alpha therapy: The “hopeful eight”.” Pharmaceutics 13.6 (2021): 906.
[5] Duchemin, Charlotte, et al. “CERN-MEDICIS: a review since commissioning in 2017.” Frontiers in Medicine 8 (2021).

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